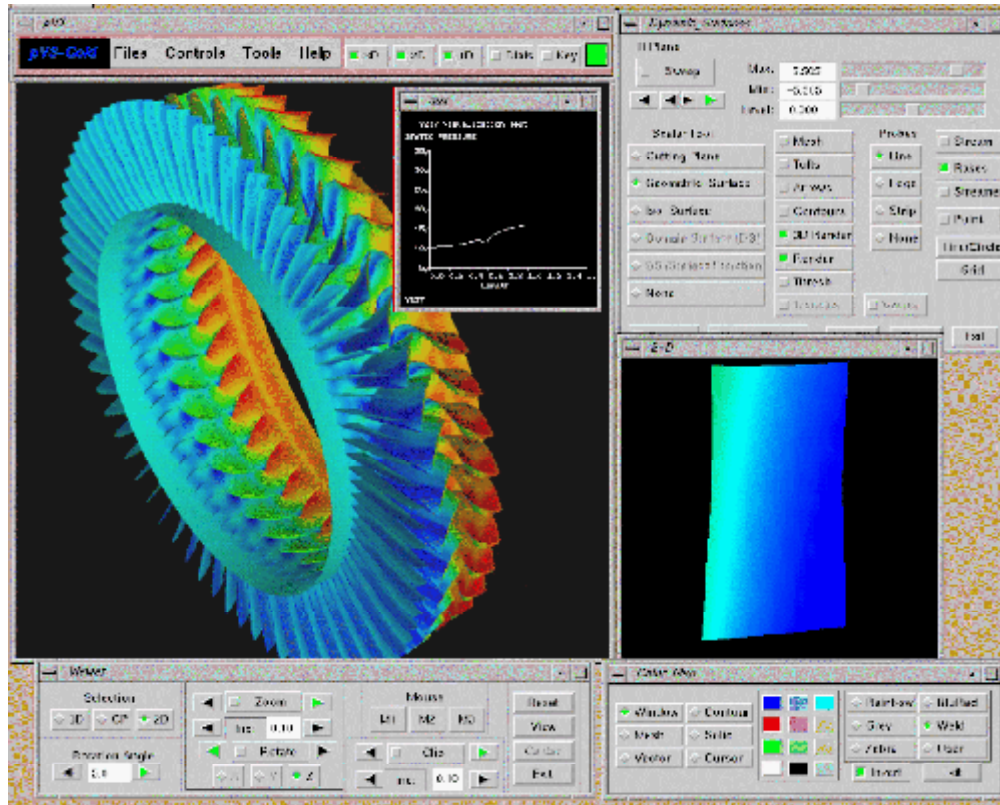


pV3-Gold Visualization Environment for Computer Simulations



Typical screen of the pV3-Gold visualization tool.

A new visualization environment, pV3-Gold, can be used during and after a computer simulation to extract and visualize the physical features in the results. This environment, which is an extension of the pV3 visualization environment developed at the Massachusetts Institute of Technology with guidance and support by researchers at the NASA Lewis Research Center, features many tools that allow users to display data in various ways.

The pV3-Gold visualization environment is designed for coprocessing multidimensional visualizations of scalar, vector, and tensor data generated in a distributed computing network. It is designed to allow the numerical solver to run as independently as possible. If the numerical procedure takes days to reach a solution, pV3 can periodically connect to the simulation, allowing users to view changing data and then disconnect.

A small amount of programming is required to merge the visualization with the numerical solver, which involves inserting function calls in the numerical solver that pass the solver data to pV3-Gold. If the data are distributed in a cluster of machines, pV3 handles this, minimizing complications for the user.

pV3-Gold is one of the tools being developed by the United Technologies Research

Center as part of the Affordable High Performance Computing Project. Work on the project is being done under a cooperative agreement between NASA Lewis and a team of industry and university partners led by Pratt & Whitney (division of United Technologies). Although the pV3-Gold visualization environment maintains all the original functions of pV3, the original pV3 interface has been replaced with an intuitive Motif graphical user interface that allows users to visualize data in one-, two- and three-dimensional view windows. Other new functions include annotation, animation recording, and feature extraction. Interactive viewing and steering of a distributed application has been demonstrated with animations recorded to MPEG (Moving Pictures Experts Group) files and video. A visualization and a movie have been done for more than one cycle of an unsteady three-dimensional turbomachinery simulation. With the pV3-Gold environment, it is now affordable to create many cycled visual representations by extracting the results as the simulation is occurring--a benefit to the aeronautics industry. Thus, the visualization of three-dimensional unsteady simulations can be a daily tool of the aeronautics design engineer.

A number of additional features are currently available in pV3-Gold. The environment handles steady-state data as well as time-varying three-dimensional data in both postprocessing and coprocessing modes, and it provides full support for structured and unstructured meshes. pV3-Gold can render three types of transient data: unsteady, deformation, and structure unsteady. Because pV3-Gold passes only the data that need to be rendered, a high bandwidth is possible. Scalar tools are available to interrogate nodal-based scalar field data such as domain surface maps, planar and arbitrary geometric cuts, and isosurfaces. Vector tools allow users to investigate steady nodal-based vector fields with various types of particles. Probes allow extraction of one-dimensional scalar data from a surface into a one-dimensional plot. Volumes can be broken into any combination of shapes: tetrahedrons, pyramids, prisms, and hexahedrons, polytetrahedral strips, and structured blocks.

The pV3-Gold environment is currently available for beta testing. Future plans for pV3-Gold include developing physical phenomena feature-extraction techniques, designing changes to the graphical user interface to support subsectioning and multidisciplinary visualization, and commercializing the software. We plan to complete these additional features by September 1997.

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